



Development, Testing, and Evaluation of a Sonex Combustion System Piston for Alternative Fuel Use in a CI Engine

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8/94–8/95

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Objective

To demonstrate the emission, efficiency, and performance advantages of the Sonex Combustion System piston for alternative fuel use in compression ignition (CI) engines.



Comparison of standard piston with Sonex piston design

Approach

Sonex will design and fabricate two sets of pistons that use the Chemical-Acoustic Combustion concept, one for diesel/biodiesel operation and the other for alcohol type fuels operation. All tests will be performed on a two-cylinder, normally aspirated diesel engine converted from a Perkins 4.236 DI engine. The performance of the engine equipped with Sonex pistons will be evaluated for power output, fuel consumption, and pollutants emission on diesel and alcohol fuels. Detailed combustion analysis will be conducted using an Ono Sokki Combustion Analyzer. Emissions to be reported will include nitric oxide/oxides of nitrogen (NO/NO_x), infrared carbon monoxide (IR CO), hydrocarbons (HCs), heated flame ionization detector (FID), and Bosch smoke (AVL 409 smoke meter).

Accomplishments

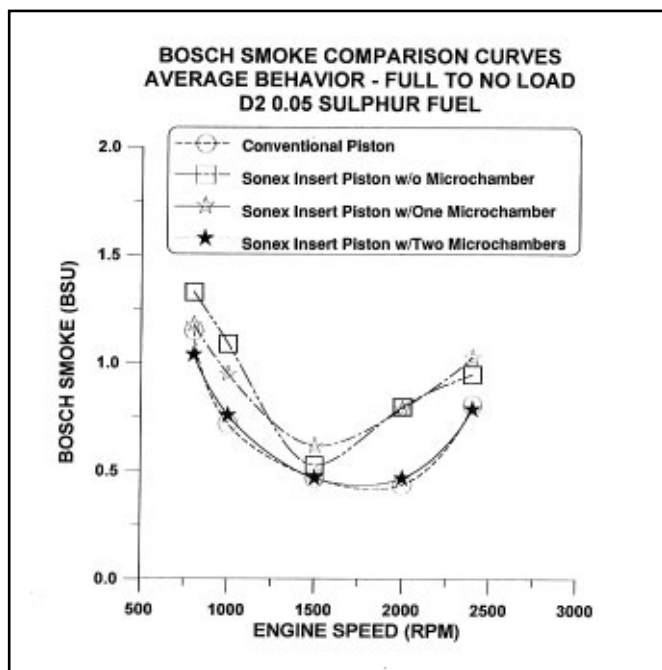
Designed and fabricated Sonex pistons for diesel and alcohol fuels. All Sonex pistons to be tested in this project are two-piece, screw-assembled pistons, each consisting of a cap with microchambers and the body made from a stock piston. The screw-assembled pistons



provide an easy and time-saving means to adjust and test Sonex piston designs. The modification of the standard diesel fuel system (including fuel pump and injectors) for alcohol fuels is also complete. The preliminary test results on diesel type fuel show that the blank insert piston (using a cap with no microchamber) increases smoke emission because of the increased crevices between the cap and the piston body. However, making one microchamber in the cap reduces smoke at low and high speeds. Using two microchambers moves the smoke curve down further over the entire engine speed range (800–2400 rpm). More smoke reduction is expected with four-microchamber pistons.

Future Direction

We will demonstrate that the Sonex Combustion System with pistons designed for alcohol use can make a normal diesel engine operate on alcohol fuels without increasing compression ratio and without any ignition improver.



Publications

Pouring, A.A. 1991. "Chemical Acoustic Charge Conditioning for Low Emission I.C. Engine," *First International Conference on Combustion Technologies for a Clean Environment*, Vol. 1, Vilamoura, Portugal, September 3–6.

Lu, J., A.K. Gupta, A.A. Pouring, and E.L. Keating. 1994. "A Preliminary Study of Chemically Enhanced Autoignition in an Internal Combustion Engine." SAE 940758.